KCM

February 28, 1996

Mr. Dave Dittmar

King County Department of Natural Resources

Water Resources Division

821 Second Avenue, MS 117

Seattle, Washington 98104-1598

Subject- North Creek Diversion Project
CS/Mll-95
Storage versus Pumping Station Elevation

Dear Dave:

Enclosed is Technical Memorandum 4.1 titled "Future Sewage Storage Tanks." The memo was done at your request to document that it was more economical to construct a small transfer lift station along with the storage than lower the North Creek Pumping Station so that storage could be emptied by gravity. As we proceeded through the analysis, the costs were so "lopsided' that the estimate was not done in great detail. The estimates and assumptions made are defined in the Technical Memorandum and are done to be consistent with the planning work being done by King County.

If you have any comments please give me a call.

Sincerely,

KCM, INC.

Barry A. Scott

Project Manager

BAS:pa
Enclosure
c: Allen de Steiguer, KCM
Doug Schneider, B&C
Bill Grosvenor, KCM
Central Files
2485028-001

February 1, 1996 KCM

To: Barry Scott, PE, KCM

c: *Central Files*

From: Bill Grosvenor

Project No.: KCM No. 2485028-007
KCDMS Contract No. CS/Mll-95

Subject: Technical Memorandum No. 4.1
Future Sewage Storage Tanks

North Creek Diversion Project
Technical Memorandum No. 4.1
Future Sewage Storage Tanks
TABLE OF CONTENTS

Title *Page No.*

LIST OF FIGURES

No. Title *Page No.*

SUMMARY

This memorandum describes the evaluation performed to determine impacts to the North Creek Pumping Station (NCPS) capacity and size if storage tanks are constructed at the pump station site. The NCPS is located on the site so that storage can be constructed at a later date without disrupting the operation of the new pump station. Storage options are not anticipated to be needed until the year 2010, according to flow projections by King County staff.

Two alternatives were considered. First, an evaluation was performed to determine the required depth of the proposed pump station that would allow flow to pass by gravity to and from storage. The required depth of storage was based on the optimization of the overall construction cost of the storage facility, balancing depth and area of the tank.

The results indicate that the pump station would have to be lowered approximately 20 feet to allow for gravity flow to and from storage. The estimated increase in the construction cost of the pump station is approximately $600,000 for excavation and increased structural cost, and an estimated $400,000 for a new intermediate floor (due to increased depth), longer pump shafting, increased ventilation, and odor control. A total increase of approximately $1 million is projected. Along with the increased capital cost, operating costs would also increase due to 20 feet more pumping head.

Second, an option was evaluated that included the cost of building a similar storage tank where the excess flow can flow into the tank by gravity, but would be pumped out of storage by a small (approximately 6- to 8-mgd) pump station. Assuming the tank remained the same with odor control, washdown, and control gates, the only addition would be the pumping station. It was assumed that the pumping station would consist of 3 rail-mounted 1,850-gpm submersible pumps located in a common drain "cell" of the storage tank.

Because of the larger cost for a deeper pumping station, it is recommended that the future storage be designed using the second option.

BACKGROUND

The North Creek Diversion Project diverts flow from the Kenmore system to the East Side Interceptor (ESI) using the York Pump Station and Redmond connection to prevent overflows of sewage to the Sammanish Slough. The method selected in the *North Creek Diversion Report* (February 1995) was to build a 68-mgd pumping station without storage to divert the peak flows to the York Pump Station. Some time in the future, depending upon the Regional Wastewater Service Plan (RWSP), selected storage may be required at the North Creek Pumping Station site. The size of storage and when it is required is dependent upon the RWSP selected.

PURPOSE

The purpose of this brief technical memorandum is to provide a cursory review the depth of the new North Creek Pumping Station and determine how it would work with future storage. The cost of storage was included with the pumping station cost at two different wet well inverts. The first wet well invert depth is based on the submergence requirements of the pumps and invert of the incoming interceptor. The second wet well invert is based on the construction

requirements of storage. This includes building the pump station with a wet well invert low enough so that the storage facility could be drained by gravity back to the pumping station.

ANALYSIS.

In order to divert sewage to storage, several common items would be required. These include a diversion structure upstream of the pumping station and storage tank. The storage tank is assumed to be buried and deep enough to allow sewage to flow in by gravity. The storage tank is assumed to be compartmentalized so that individual cells are filled sequentially and only when needed. It was also assumed that each cell would include space for a gate, washdown system, and connection to an odor control system- Since these are common elements, no cost evaluation of these elements was done.

The relationship of storage depth and footprint area was done in a preliminary fashion to achieve some level of optimization in costs. Figure 4.1.1 shows how the assumed storage would fit on the pumping station site. Figures 4.1.2 through 4.1.4 show top and bottom plans with a section through the storage tanks. The bottom (invert) elevation of tank would be about elevation 90.0. This elevation would require the pumping station to be deepened about 20 feet to elevation 83 to allow gravity return flow from storage.

A preliminary structural cost estimate was done to determine the incremental increase in cost due to increased depth of the station. The deepened structure was estimated to cost approximately $600,000. Estimated cost includes additional excavation, dewatering and structural concrete. In order to keep the pumping station walls at a reasonable thickness, it was assumed that an additional intermediate floor would be 'required. No estimate was done for the increased equipment costs, but it was assumed that they would also increase because of the added depth of the stations and resulting pumping head and horsepower required. Anticipated cost increases include lager motors, generator, switchgear, transformers, variable-frequency drives, ventilation, pump staffing and pumps. Without doing an extensive estimate, it is anticipated that these additional costs could be in the $400,000 to $500,000 range. This would increase the capital cost of the pump station by approximately $1,000,000.

There will also be an increase in operating cost. The deeper wet well will increase the average pumping head by about 20 feet This increase in head will increase the average power cost by about 20 percent. It is impossible to say what the actual dollars are since currently the anticipated average pumping capacity is unknown.

These costs were compared to the second option, the addition of a small 6- to 8-mgd pump station built within the storage tank. The cost assumed four small 2,000-gpm submersible 20hp pumps, which would empty 2.5 million gallons of storage in about 12 hours. The pump station would cost about $150,000.

RECOMMENDATION

In order to have gravity flow into storage and gravity flow back to the North Creek Pumping Station, the station would have to be about 20 feet deeper than necessary. The costs associated with increasing the depth, both capital and operating, far exceed the cost of pumping from storage. It is therefore recommended that the storage facility be designed with a pumping station and the North Creek Pump Station be constructed as shallow as possible.

APPENDIX 4.1.1